Difference Equations

2.1.1 Compound Interest

2.1.2 Loan Repayment

2.1.3 Gambler's Ruin

2.2.2 Exponential Population Growth

2.2.3 Average Lifespan

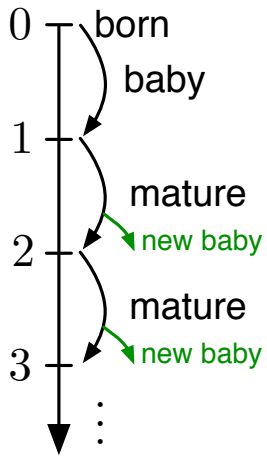
2.2.⋆ Rabbit Populations

2.2.4 Nonlinear Population Models

2.2.⋆ Rabbit Populations

Consider the following rabbit population

- Rabbits live forever
- They are babies for 1 season (don't reproduce)
- They become mature adults after 1 season
- A pair of mature adults has 1 pair of baby rabbits each season



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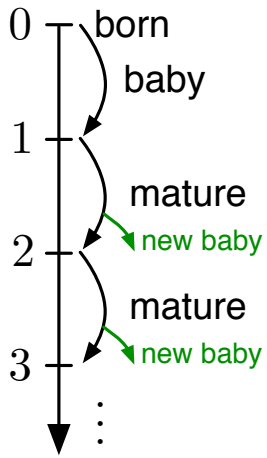
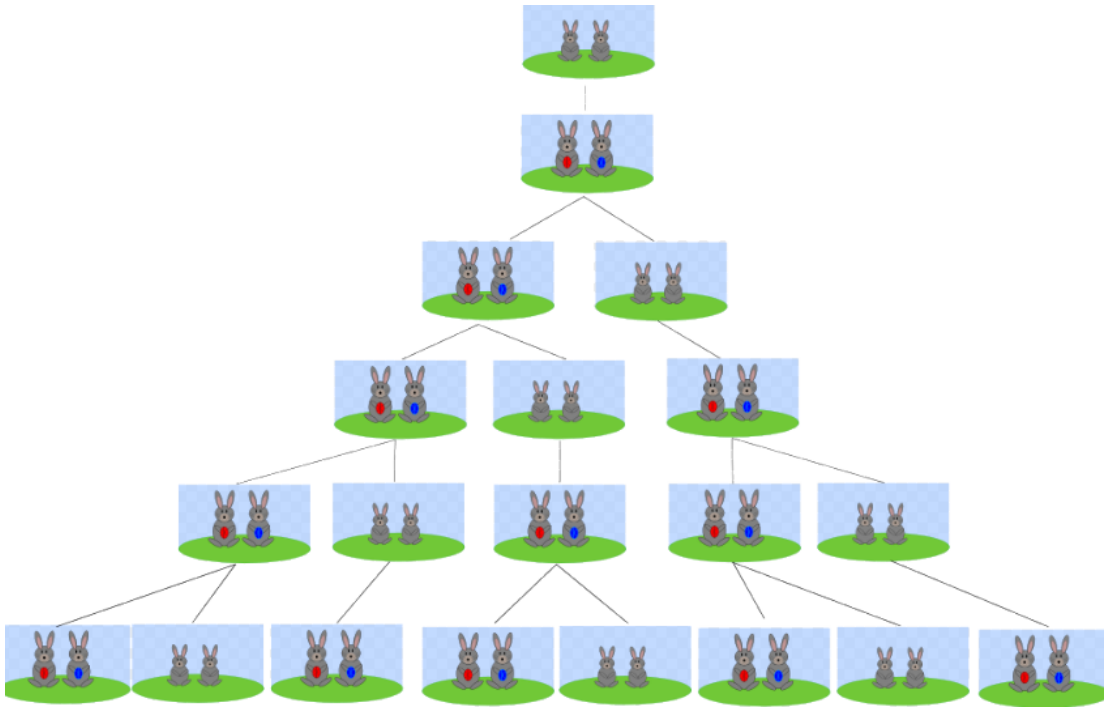


1. Model the rabbit population: Difference equation and conditions
2. Show that the Difference equation found follows from the "rules" above
3. Find an explicit formula for the solution.
   Hint. Assume the solution is an exponential r^k.

2.2.⋆ Rabbit Populations

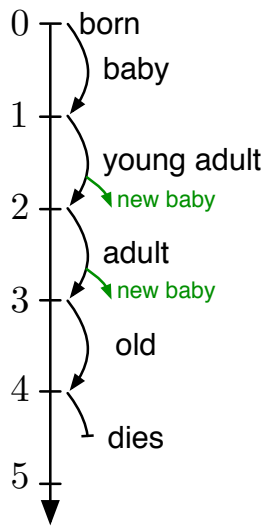


by Houman Madani (MAT231 '16)

Complicated Rabbits

Consider a rabbit population with the following lifecycle:

$t = 0$.	Newborn	(doesn't reproduce)
$t = 1$.	Baby	(doesn't reproduce)
$t = 2$.	Young Adult	(reproduces)
$t = 3$.	Adult	(reproduces)
$t = 4$.	Old	(doesn't reproduce)
$t = 5$.	Dead	



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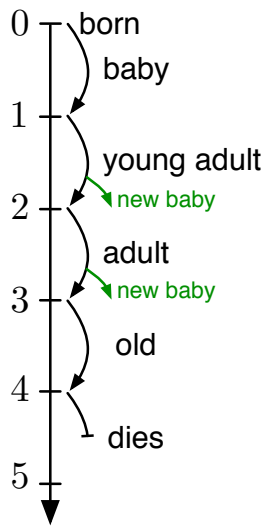
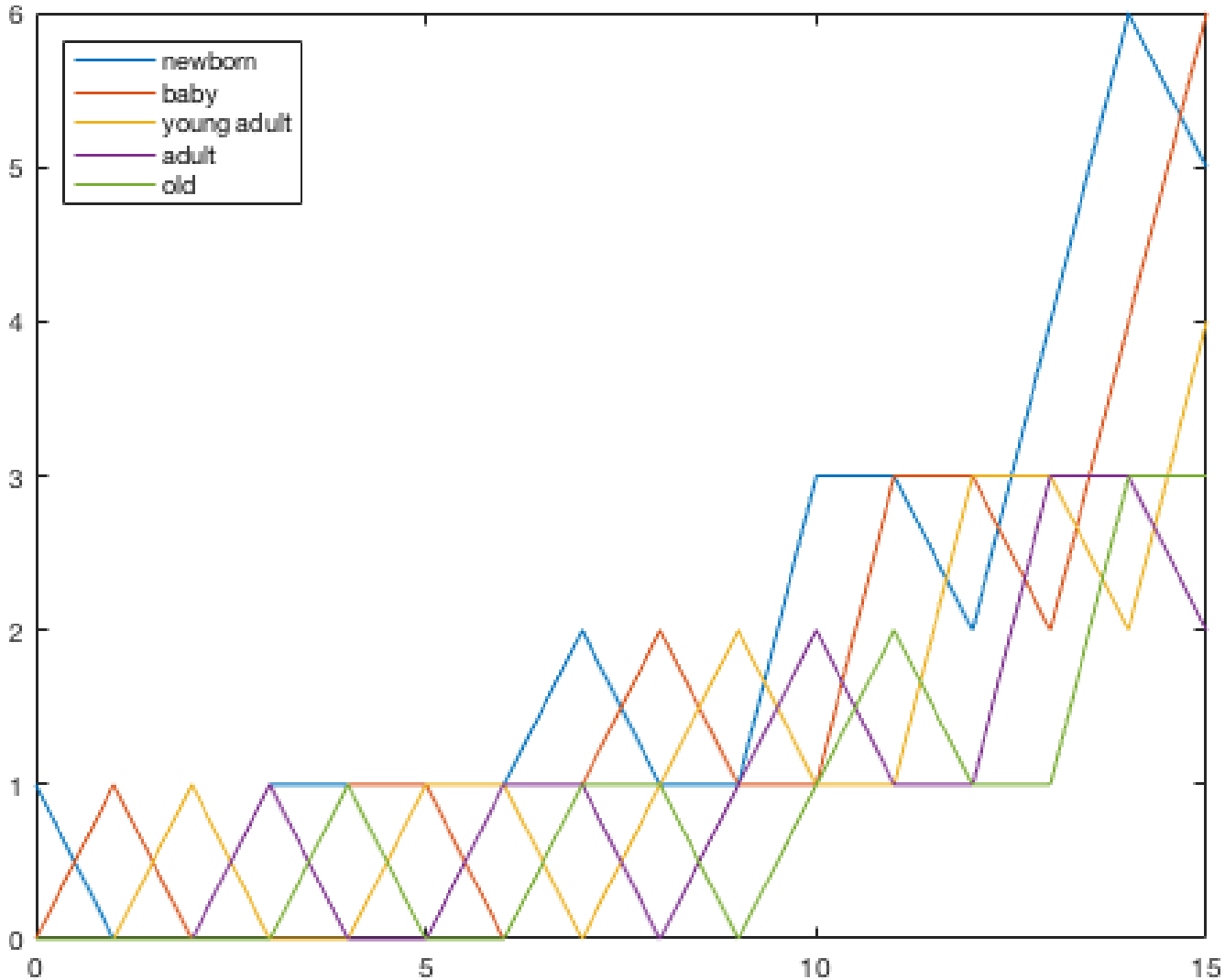


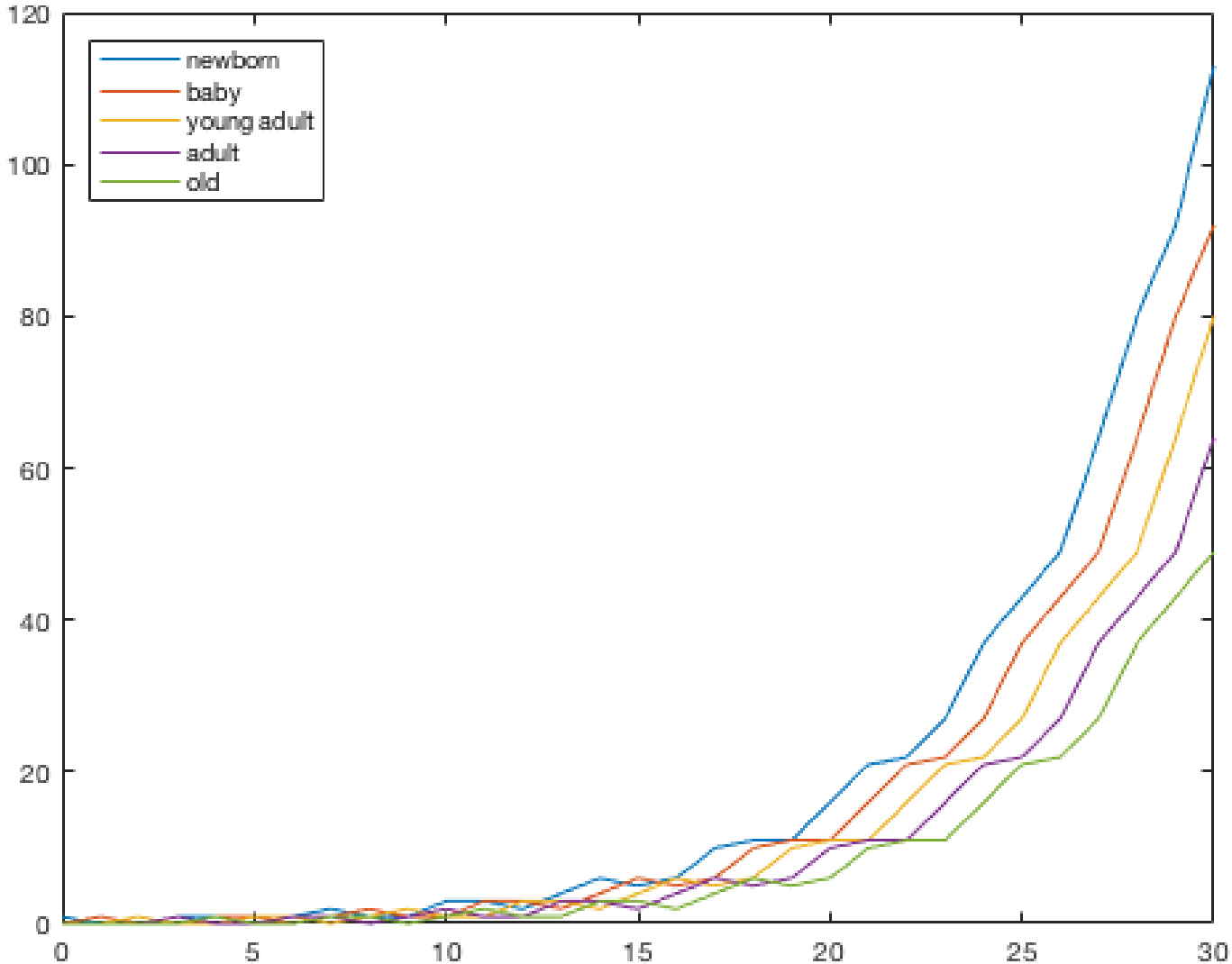
4. Model the rabbit population: Define sequence(s), Difference equation and conditions.

5. Find an explicit formula for the solution.

Complicated Rabbits



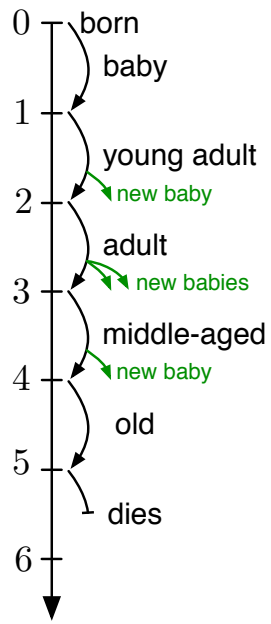
Complicated Rabbits



More Complicated Rabbits

Consider an even more complicated rabbit population:

$t = 0$.	Newborn	(doesn't reproduce)
$t = 1$.	Baby	(doesn't reproduce)
$t = 2$.	Young Adult	(reproduces 1 pair)
$t = 3$.	Adult	(reproduces 2 pairs)
$t = 4$.	Middle-Aged	(reproduces 1 pair)
$t = 5$.	Old	(doesn't reproduce)
$t = 6$.	Dead	



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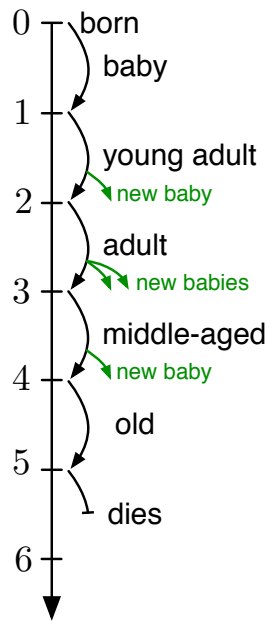

6. Model the rabbit population: Define sequence(s), Difference equation and conditions.
7. Compare the matrices for the last two Rabbit populations. Identify the blocks of the matrices and what they represent.

Preparation for next lecture

More Complicated Rabbits

- Solve the questions 6 , 7.

Preparation for next lecture

Complicated Rabbits

- Solve the questions 4 , 5.